Space Weather Technical Forecast

Issued on Wednesday, 03 July 2024 at 13:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of M-class flares throughout. Chance of Active to G1/Minor storm intervals Day 1 (03 Jul) due to CME influences.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with AR3730 producing an M1.5 flare at 03/0741 UTC. This is a very small and simple region, yet it has been responsible for two M-flares in the last few days. There are now twelve regions on the disc, the majority of which are small and simple. AR3729, near south-centre disc, is currently the largest and most complex region on the disc. However, it has lost its delta spot and the majority of its trailing spots have limited penumbra. To the north of AR3729 is AR3733 which has developed a little in the last 24 hours, but remains fairly simple. AR3734, in the northeast quadrant, is very elongated but rather small in areal extent and simple in terms of magnetic complexity. A new region has recently emerged onto the southeast limb, but is not yet fully visible so the classification may change as it rotates further onto the disc.

A large filament was observed lifting off the Sun's surface in the northwest at around 02/1915 UTC but did not appear to produce a significant CME. The M1.5 flare mentioned above has produced a CME but there is limited coronagraph imagery at present to assess this. However, it appears unlikely to be Earth directed. No other Earth directed CMEs have been observed in imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 showed a decline to background levels. Wind speeds declined from around 400 to near 330 km/s with a below average density. The Interplanetary Magnetic Field, Bt, was weak throughout, but with a slight increase to reach 5nT. The north-south component, Bz, varied weakly between +3/-4nT. Phi angle has been predominantly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 reached moderate levels with a peak of 641pfu at 02/1720 UTC. The 24-hour fluence remained below Active on a rising trend, with 1.79e7 integrated pfu observed at 03/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is most likely, with a chance of further isolated M-flares.

Solar Wind / Geomagnetic Activity: A CME was observed leaving the Sun on 29 June, which may give a glancing blow at Earth on Day 1 (03 Jul), however confidence is low, with significant uncertainty in the timing of this feature. No other Earth directed CMEs are currently expected, and there are no significant coronal holes in a position to give any fast wind influence during this period.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with a chance of Active to G1/Minor storm (Kp 4-5) intervals on Day 1, should the CME arrive.

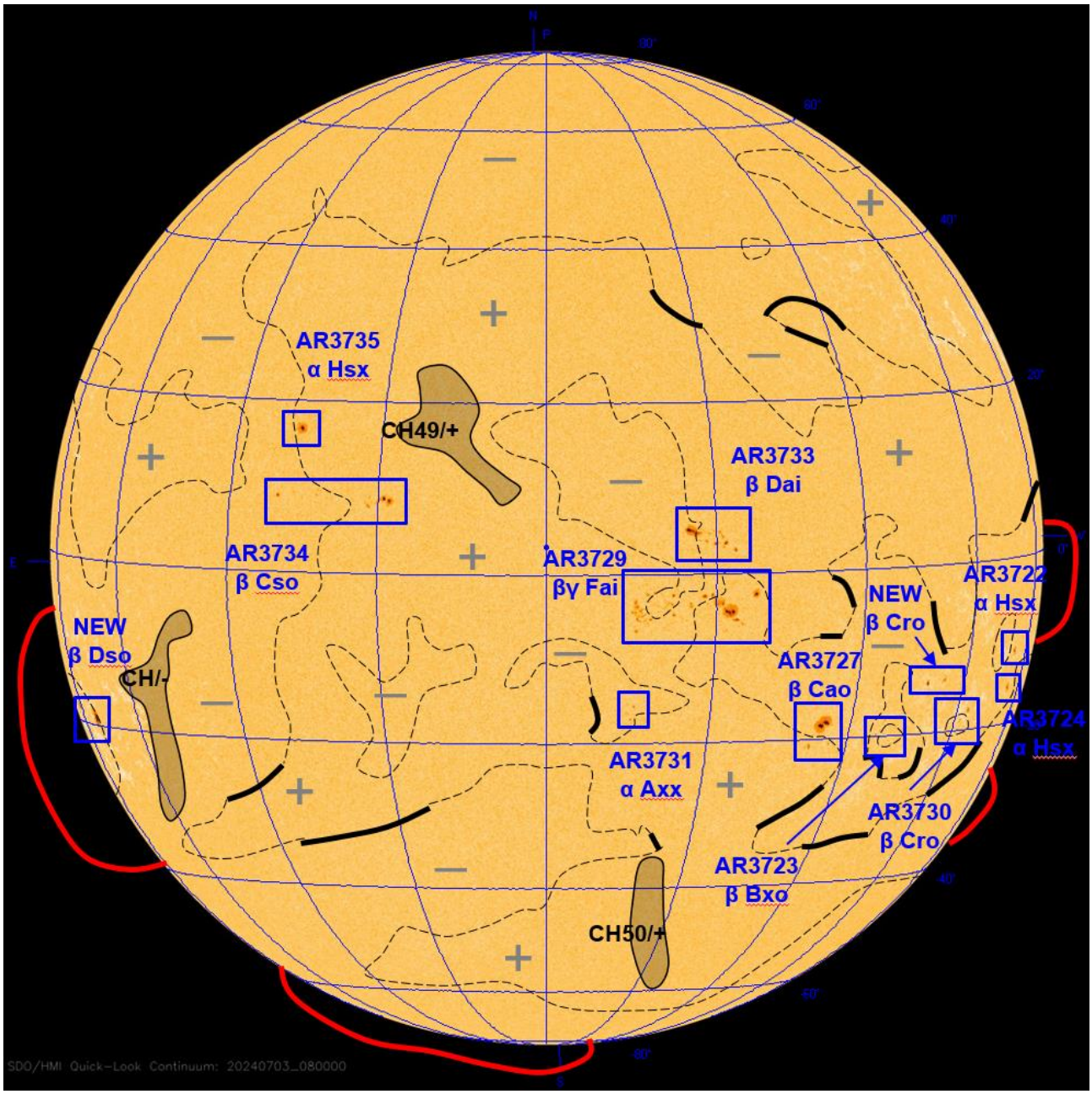
Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels. However, there is a very slight chance of exceeding the S1/Minor Storm threshold should any notable flares occur. High energy electron flux has shown an increasing

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

trend after the recent CME influence. There is the possibility of a further increase, but confidence is low and the most likely outcome is for the electron flux to remain at background to moderate levels. The associated 24-hour fluence is likely to remain below the Active threshold, albeit perhaps with a slight rising trend.

Figure 1. Solar Analysis Valid 03/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

A large filament lift-off was observed around 29/1530 UTC in the southwest, followed by a CME visible on coronagraph imagery. Analysis suggests a glancing blow at Earth on Day 1 (03 Jul), however confidence is low. The bulk of the ejecta is expected to be passing below Earths orbit, with significant uncertainty in the timing of this feature.

No other Earth directed CMEs are currently expected, and there are no significant coronal holes in a position to give any fast wind influence during this period.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with a chance of Active to G1/Minor storm (Kp 4-5) intervals on Day 1, should the CME arrive.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	5	1	1
Strong	G3	No	5	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

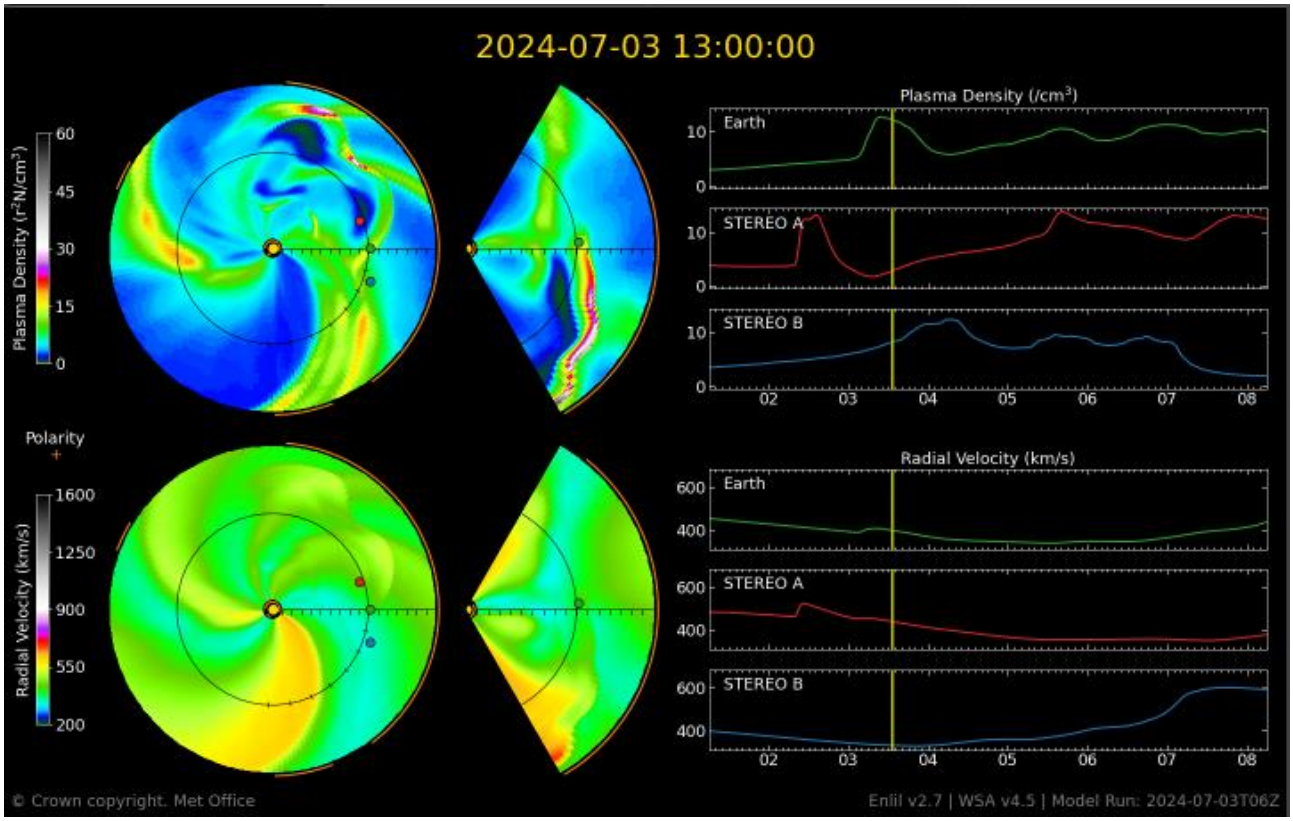
Geomagnetic Activity - Earthbound Coronal Mass Ejections

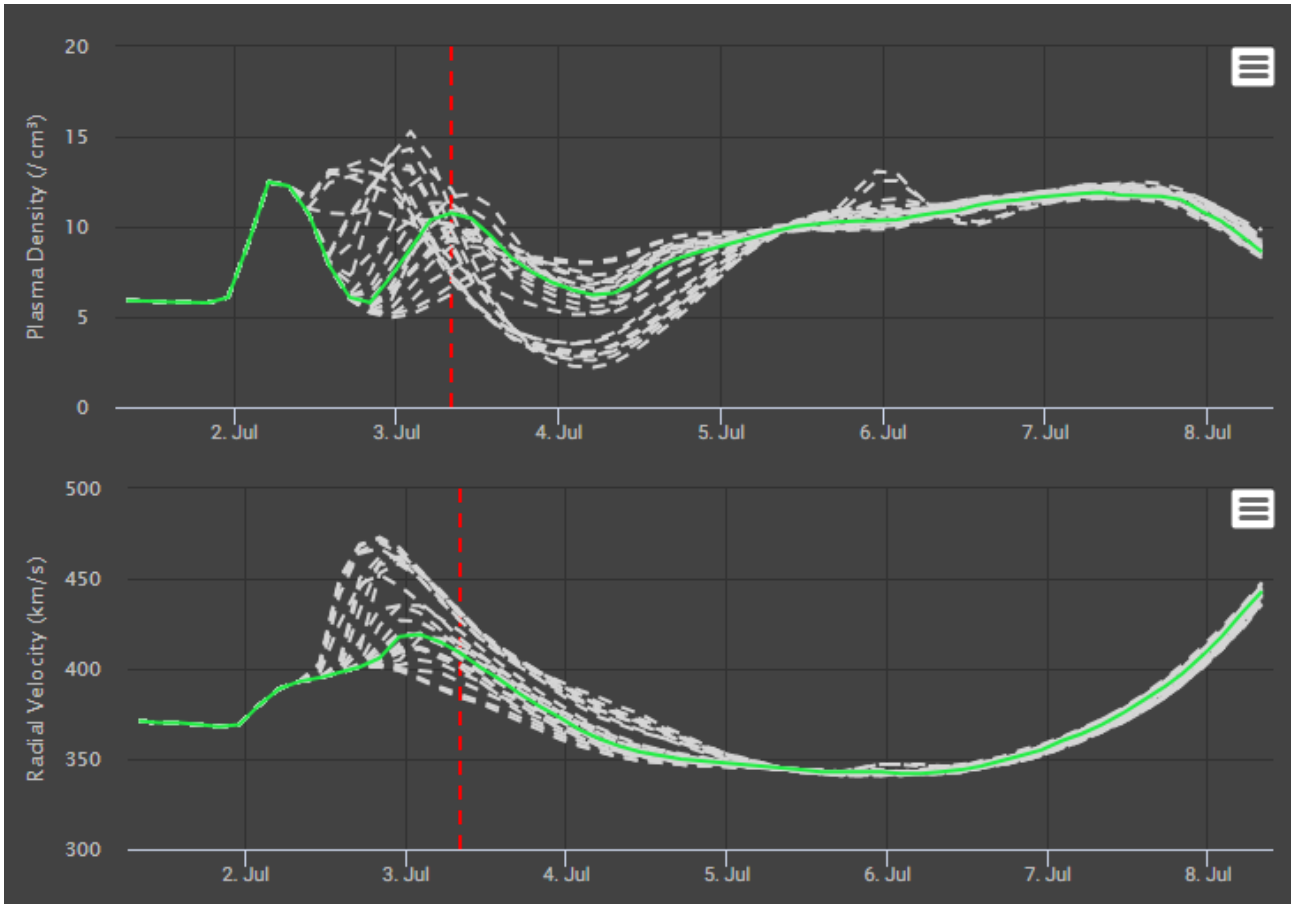
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/2010	Partial	Filament	SW	780 km/s	03/0000 UTC +/- 12 hrs	Glancing blow possible. Timing uncertain.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: MOSWOOC Enlil and ensemble, showing a potential CME arrival at Earth today.





Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

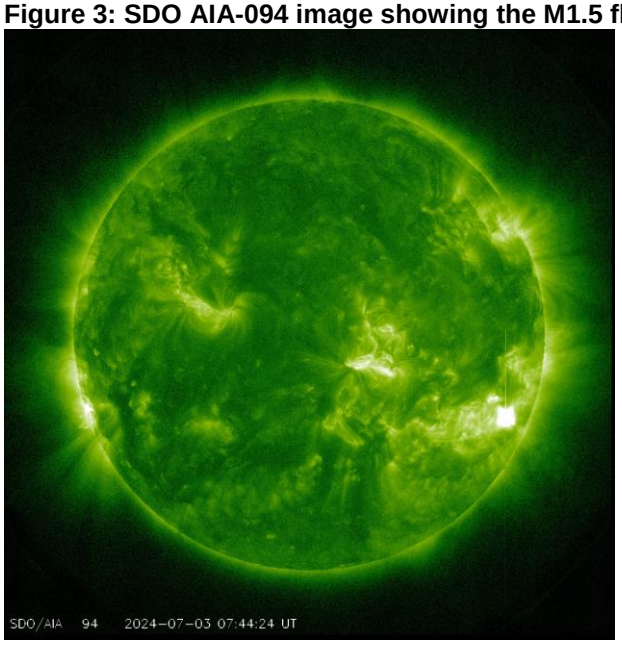
Radio Blackouts - X-Ray Flares:
Solar activity has been Moderate, with AR3730 (Cro/Beta) producing an M1.5 flare at 03/0741 UTC. This is a very small and simple region, yet it has been responsible for two M-flares in the last few days.

There are now twelve regions on the disc, with AR3721, AR3728 and AR3732 all having faded. The majority of the remaining regions are small and simple. AR3729 (Fai/Beta-Gamma), near south-centre disc, is currently the largest and most complex region on the disc. However, it has lost its delta spot and the majority of its trailing spots have limited penumbra. To the north of AR3729 is AR3733 (Dai/Beta) which has developed a little in the last 24 hours, but remains fairly simple. AR3734 (Cso/Beta), in the northeast quadrant, is very elongated but rather small in areal extent and simple in terms of magnetic complexity. A new region has recently emerged onto the southeast limb, but is not yet fully visible so the classification may change as it rotates further onto the disc.

Each individual region only contributes a small amount to the overall flare risk. Overall, the flare risk has been kept flat throughout with a chance of isolated M-class flares, and a very slight chance of X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: SDO AIA-094 image showing the M1.5 flare from AR3730 in the southwest.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as measured by GOES-18, is most likely to remain at background levels. Despite a large amount of sunspots on the Earth-facing disc, they are relatively small and magnetically simple, making proton enhancements unlikely.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

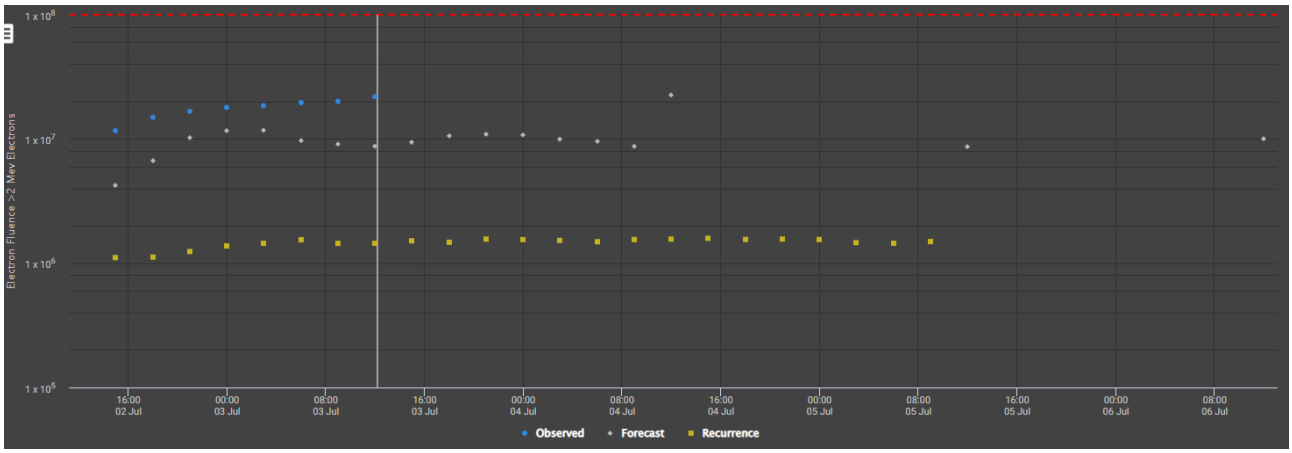
© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
High energy electron flux, as observed by GOES-16, has been at background to moderate levels over the last 24 hours, peaking at 641pfu at 02/1720 UTC. This was due to the relaxation of the Van Allen belts following the CME enhancement on 28 June. There is the potential for another CME arrival on Day 1 (03 Jul) which could suppress electron flux in the short term. It could then cause an increase in the electron flux later in the period, but this is somewhat dependent on any geomagnetic activity arising from this feature, which is low confidence. Overall, electron flux is most likely to continue to peak at moderate levels over the coming days, but there is a slight chance of flux increasing during the period to reach high levels.

Associated electron fluence is most likely to persist below the Active threshold (1e8 integrated pfu), with a slight chance of an increase above Active. MOSWOC REFM is forecasting a below Active trend through the next three days, which reflects the most probable outcome.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	10	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a below Active forecast, which seems like good guidance.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.